

APPENDIX G

Waterways Experiment Station Modeling Results

The U.S. Army Engineer Research and Development Center, Coastal and Hydraulics Laboratory (CHL) completed a salinity intrusion analysis regarding the Project in 1996 (Corps, 1999a). As a result of the SEI panel comments, a limited additional analysis was performed to assess the potential impacts at 70,000 cfs, a very low river discharge. Issues included in the analysis were deepening impacts on salinity, velocity, and depth as revealed in the existing CHL numerical model (ECHL) of the Columbia River Estuary.

Model development and verification for the ECHL model of the Columbia River Estuary are explained in the Corps' FEIS (Corps, 1999a). The same model was used to compute results for the 70,000-cfs inflow case requested by the SEI panel. The results for project impacts to salinity intrusion, current velocities, and water surface elevations are presented in this appendix in Figures 1-20.

Based on the WES RMA-10 modeling, the 70,000 cfs low flow condition resulted in the largest impacts on salinity intrusion. As with the analysis for 120,000 cfs and 134,000 cfs (USACE, 1999a), the salinity concentration increases were predicted to be larger at the bottom of the water column than at the surface. For this base versus plan comparison, the model predicts that deepening the channel would increase surface salinity in the estuary by a maximum of 0.15 ppt (Figure 2). In particular, the 0.1-0.15 ppt range of increase shows up in shallow areas of Cathlamet Bay and Grays Bay (figure 10). Bottom salinity increases in the range of 1.0-1.5 ppt are predicted to occur at the bottom of the navigation channel in the vicinity of Tongue Point and back through the Miller Sands channel (Figure 3). Bottom salinity concentrations increases of 0.3 to 0.4 ppt are predicted in the deeper channels of Cathlamet Bay, near Tongue Point (Figure 12).

The WES model indicates that the impact of channel deepening on surface water elevation is minimal. Differences between base and plan are estimated to range between -0.02 feet and 0.02 feet for all locations between the mouth and the upper estuary (Figure 4).

Velocity changes predicted as a result of the deepening are also very small, with the most change generally occur along the navigation channel (Figures 6 and 8). Velocity changes in the shallow water areas of Cathlamet and Grays Bays are predicted to be near zero (Figure 17).

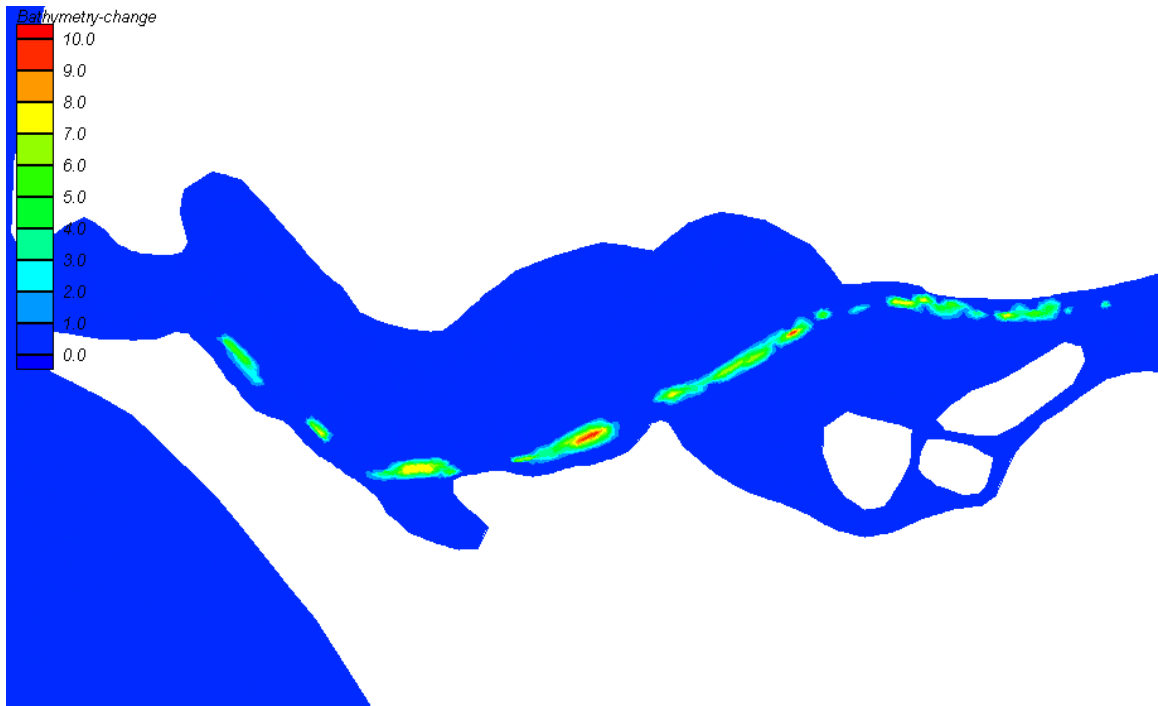


Figure 1. Bathymetric differences between plan and base. (10 ft changes indicated are at channel edges only.)

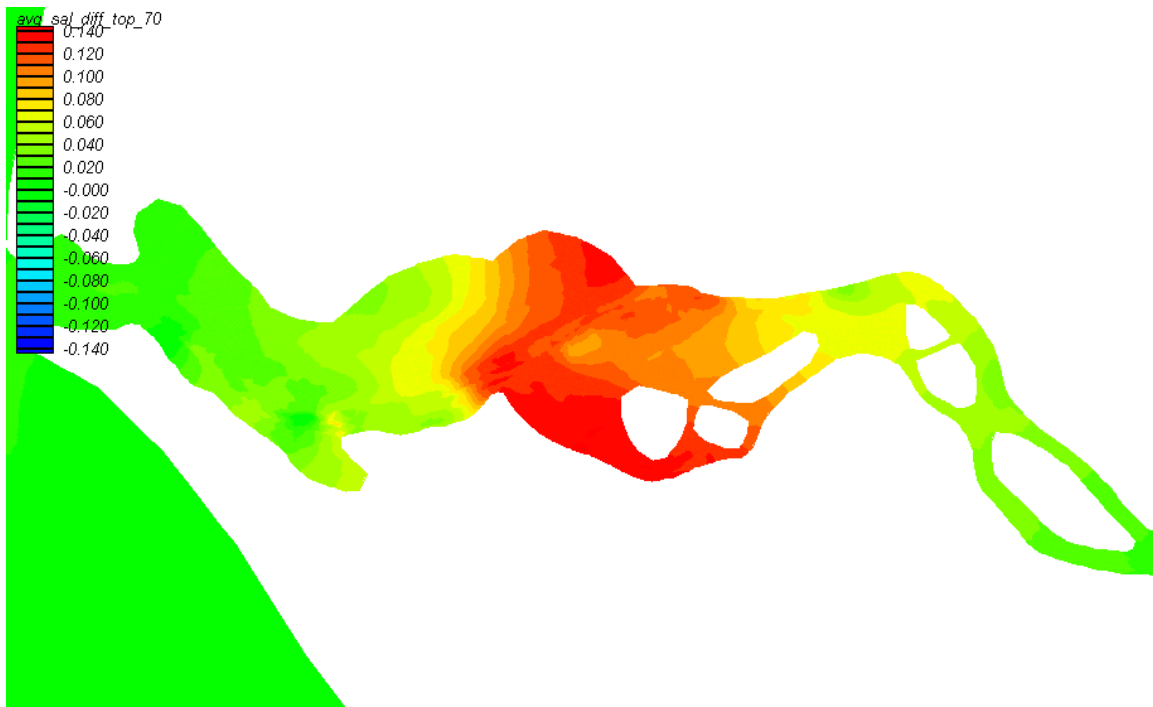


Figure 2. Average surface salinity differences. 70k flow.

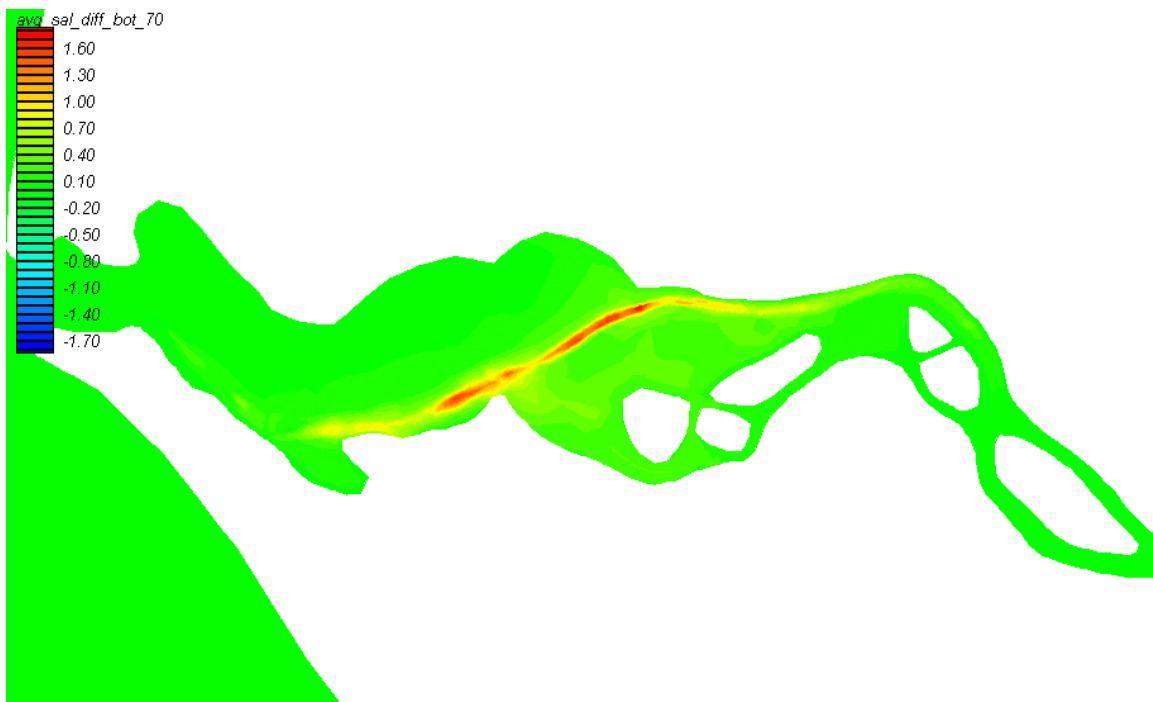


Figure 3. Average bottom salinity differences. 70k flow.

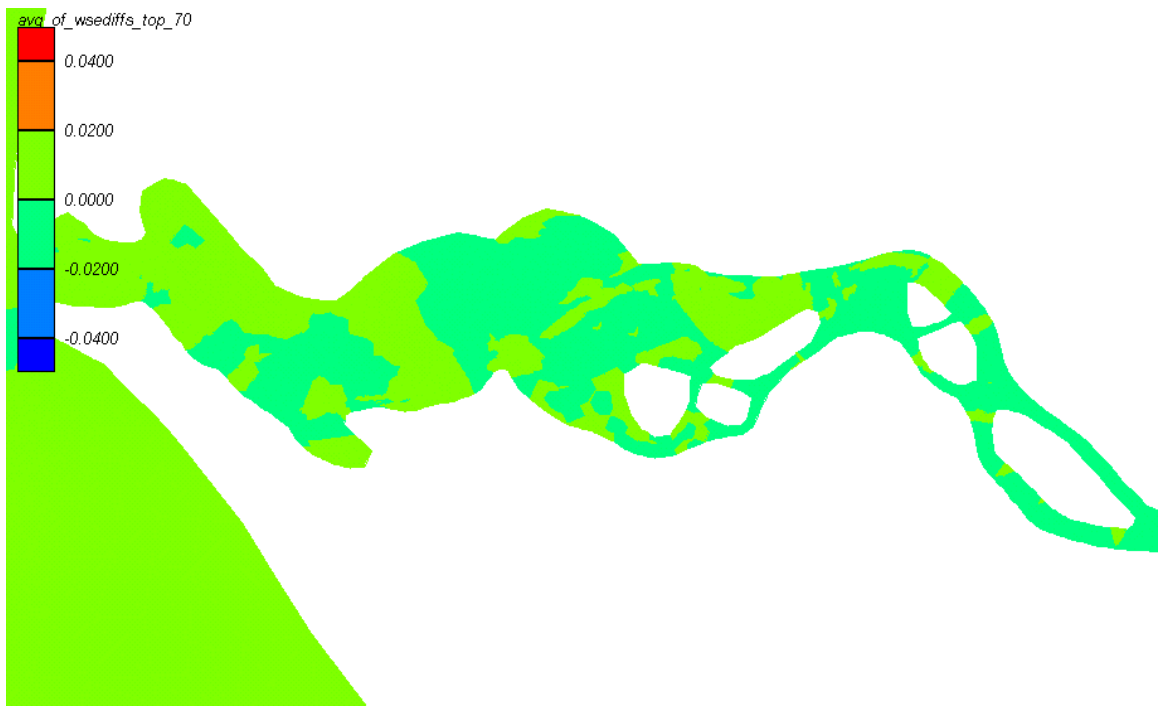


Figure 4. Average water surface elevation difference (ft). 70k flow.

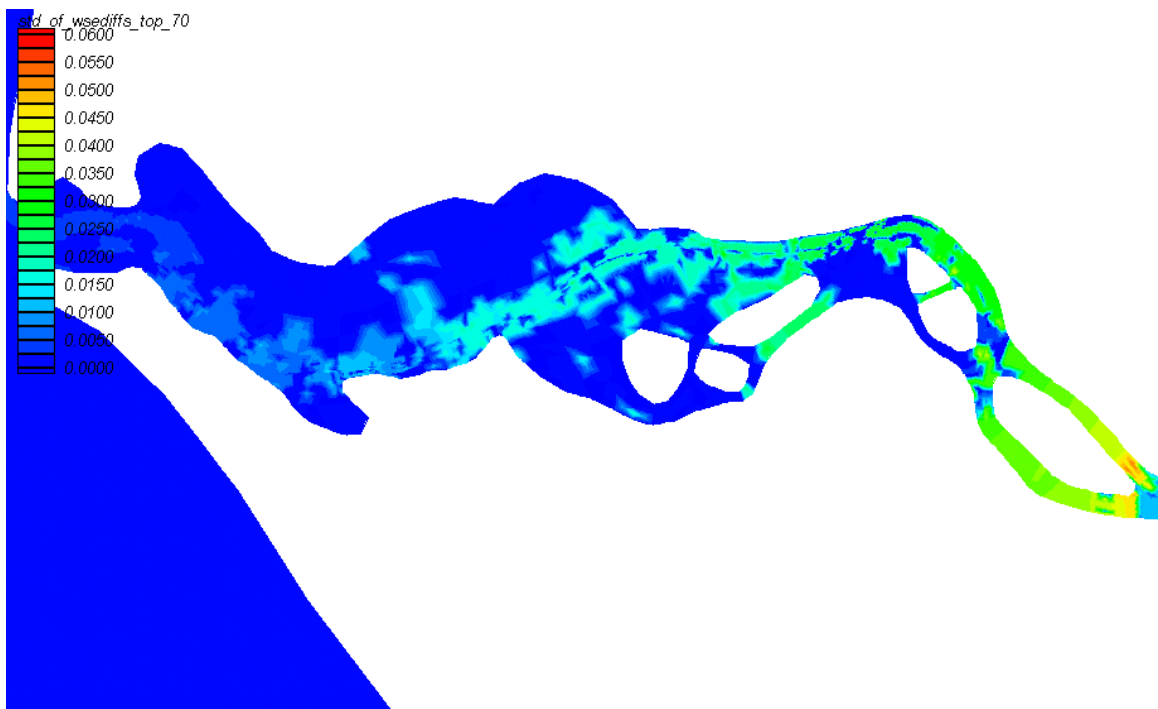


Figure 5. Standard deviation of water surface elevation differences (ft). 70k flow

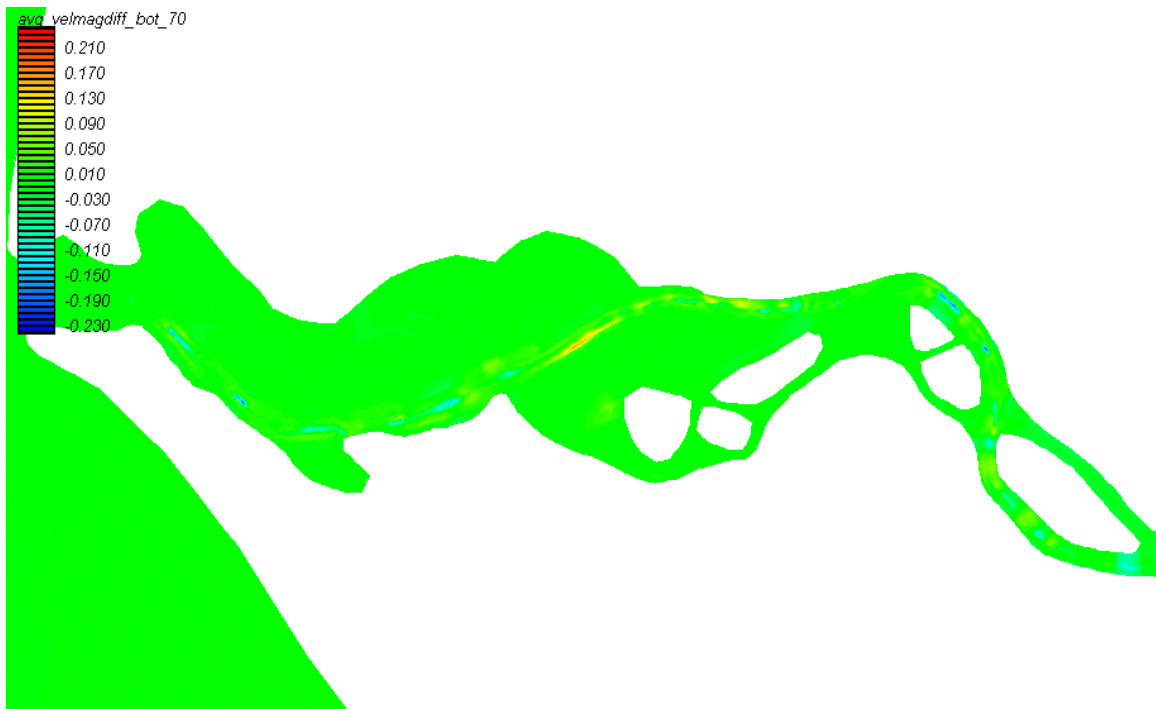


Figure 6. Average bottom velocity magnitude difference (ft/sec). 70k flow.

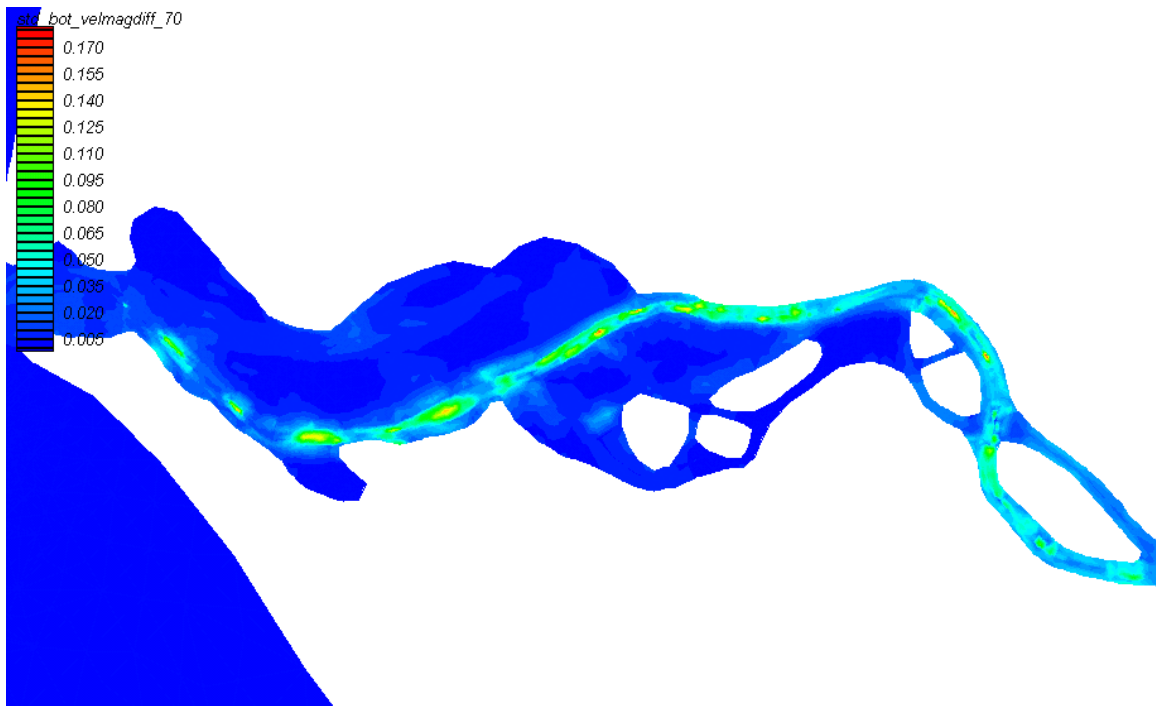


Figure 7. Standard deviation of bottom velocity magnitude difference (ft/sec). 70k flow

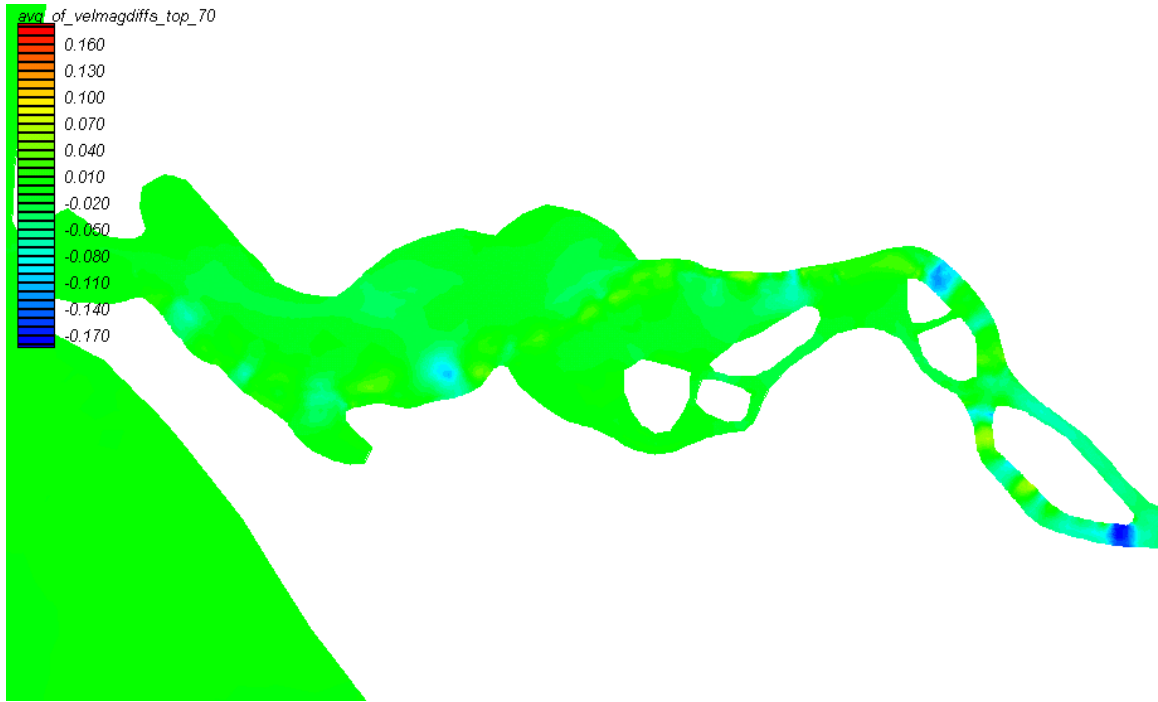


Figure 8. Average surface velocity magnitude differences (ft/sec). 70k flow.

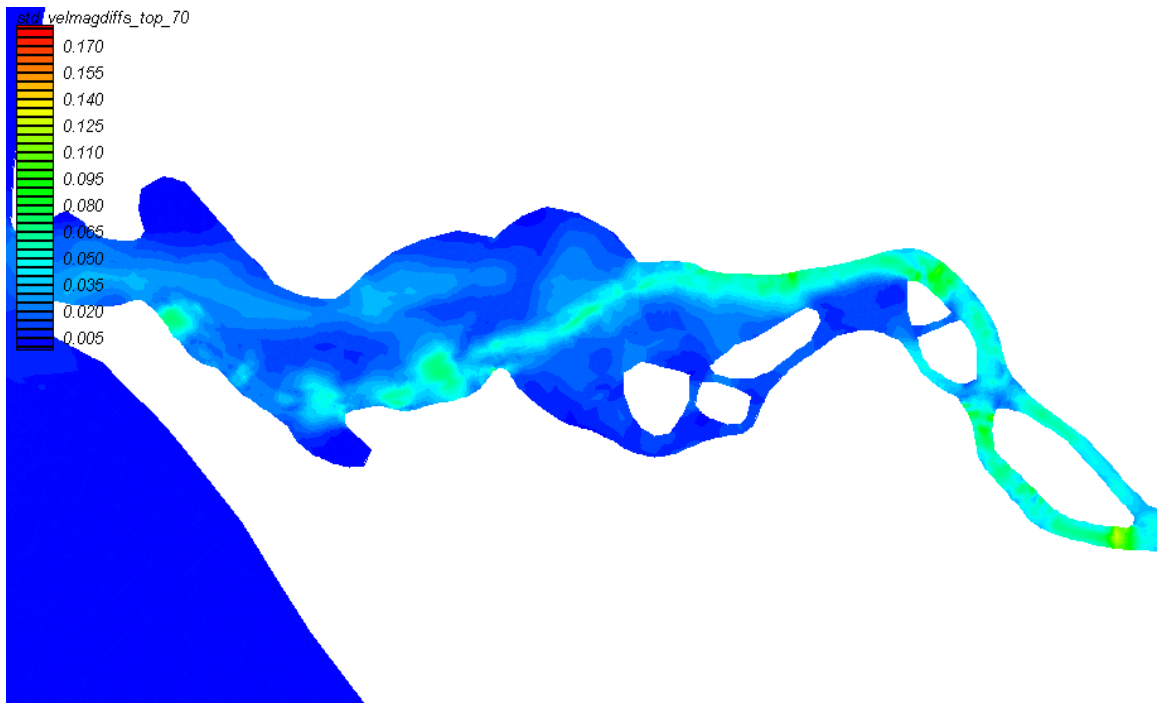


Figure 9. Standard deviation of surface velocity magnitude differences (ft/sec). 70k flow.



Figure 10. Cathlamet Bay average surface salinity differences. 70k flow.

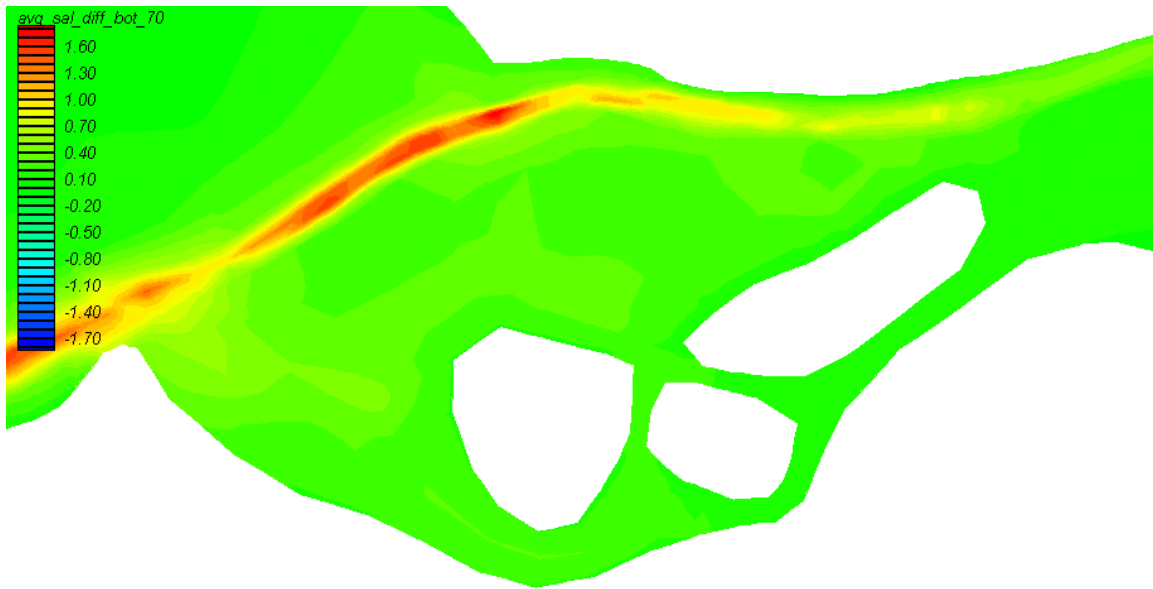


Figure 11. Cathlamet Bay average bottom salinity differences. 70k flow.

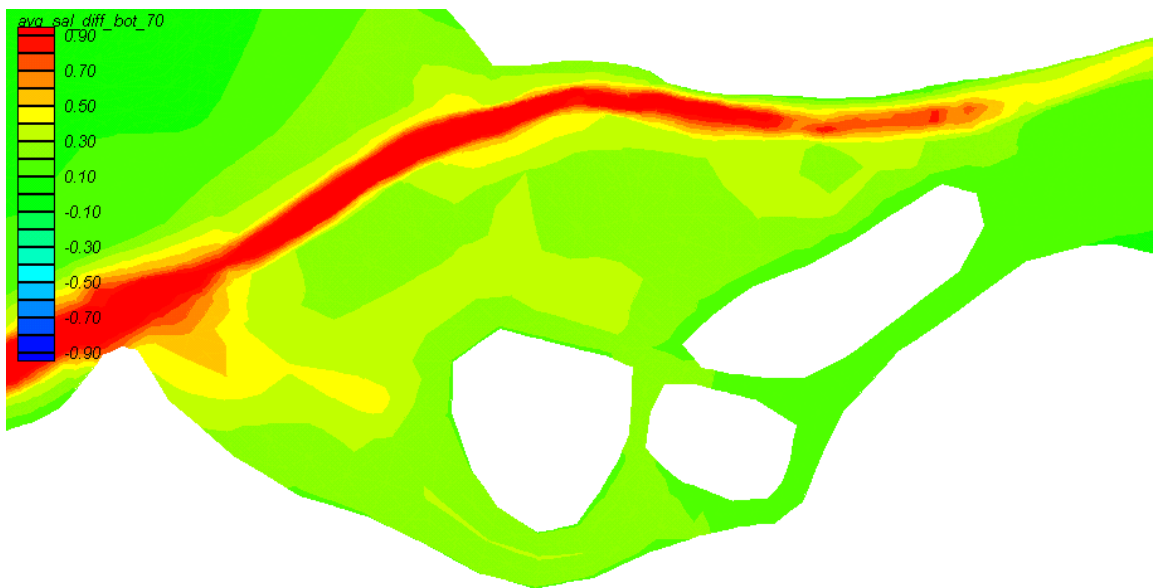


Figure 12. Cathlamet Bay average bottom salinity differences. 70k flow. Finer scale.

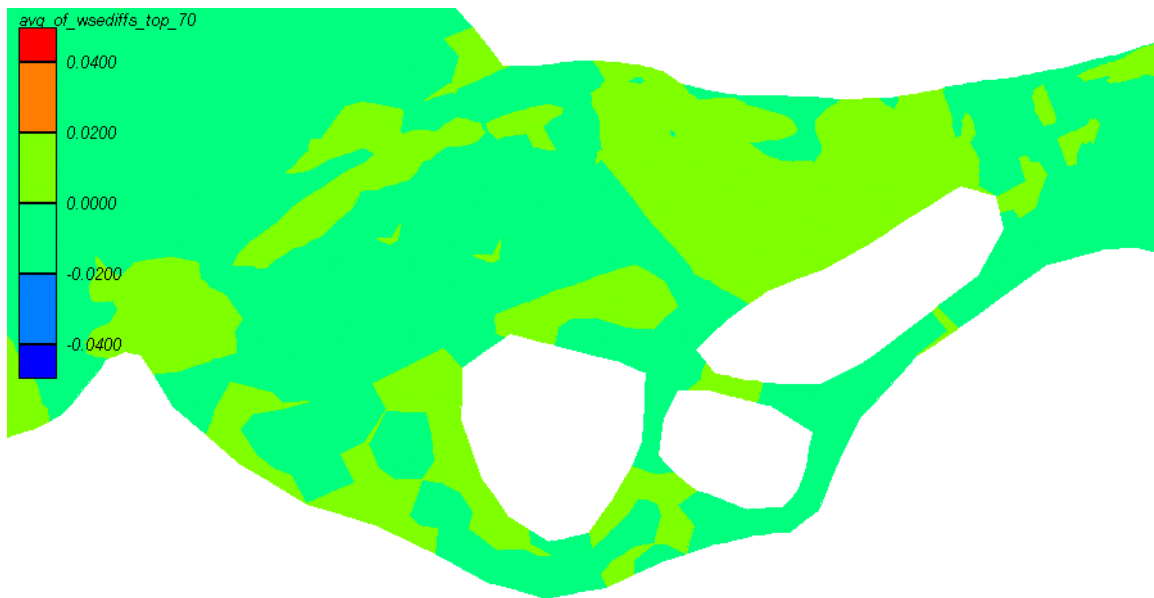


Figure 13. Cathlamet Bay average water surface elevation difference (ft). 70k flow.

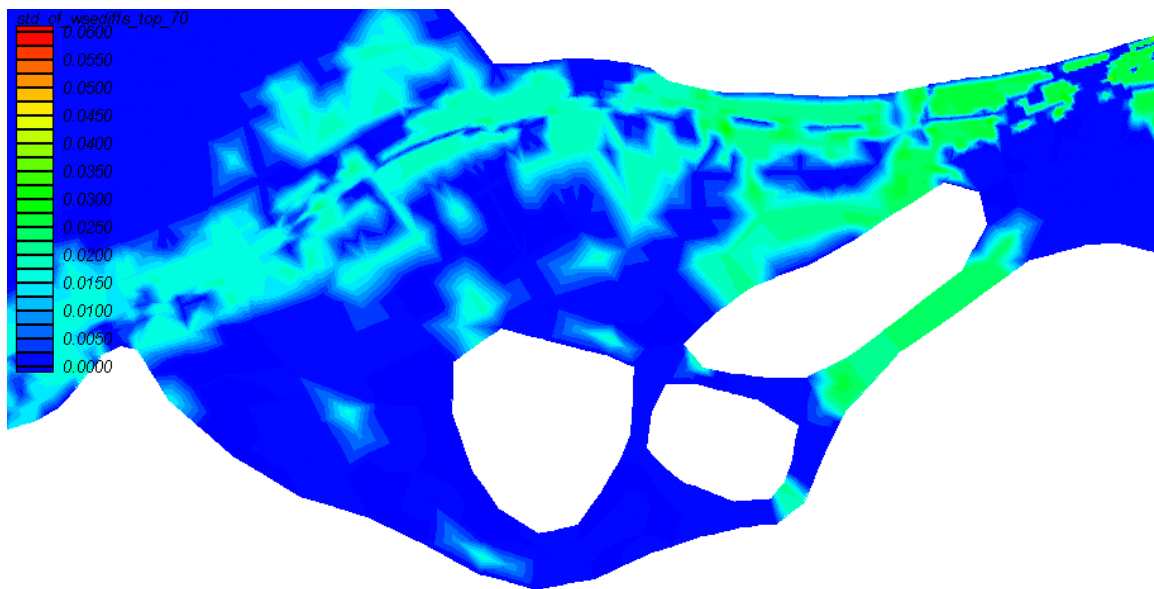


Figure 14. Cathlamet Bay standard deviation of water surface elevation differences (ft). 70k flow.

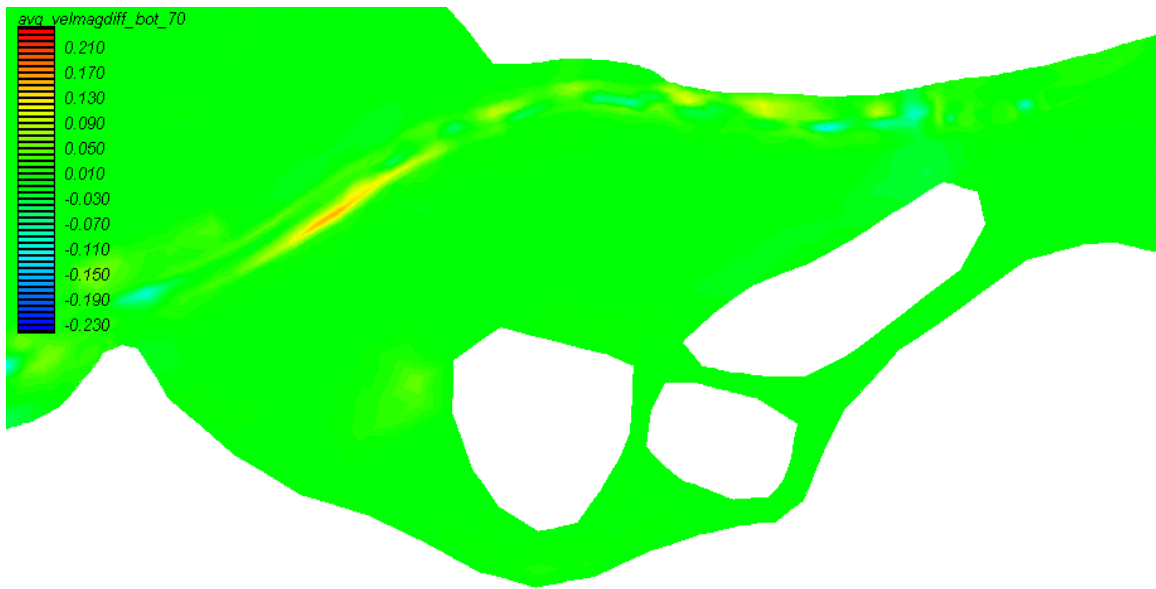


Figure 15. Cathlamet Bay bottom velocity magnitude difference (ft/sec). 70k flow.

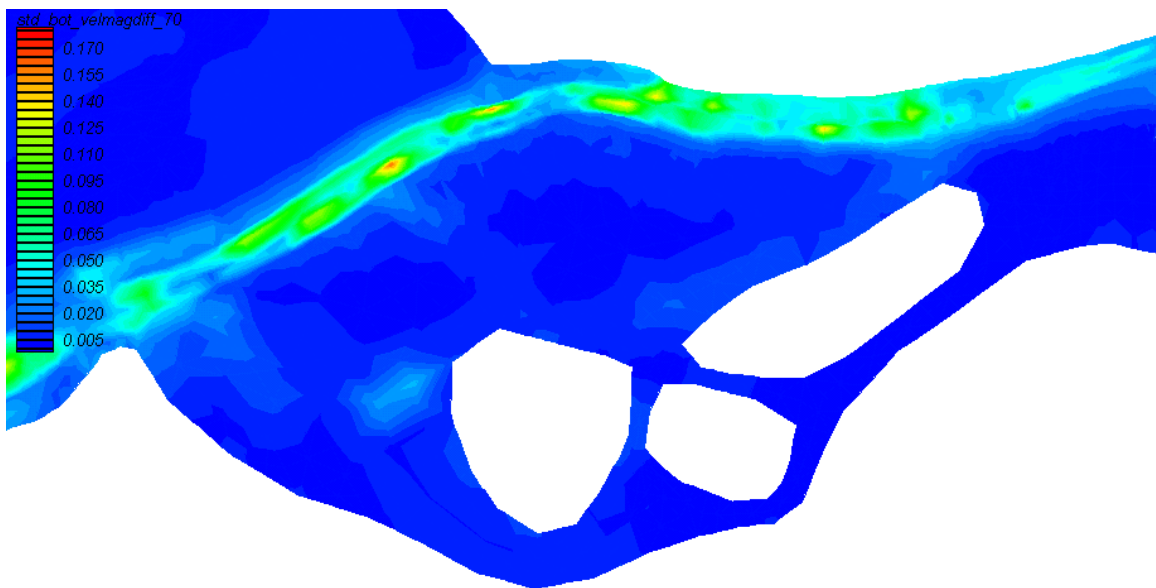


Figure 16. Cathlamet Bay standard deviation of bottom velocity magnitude difference (ft/sec). 70k flow.

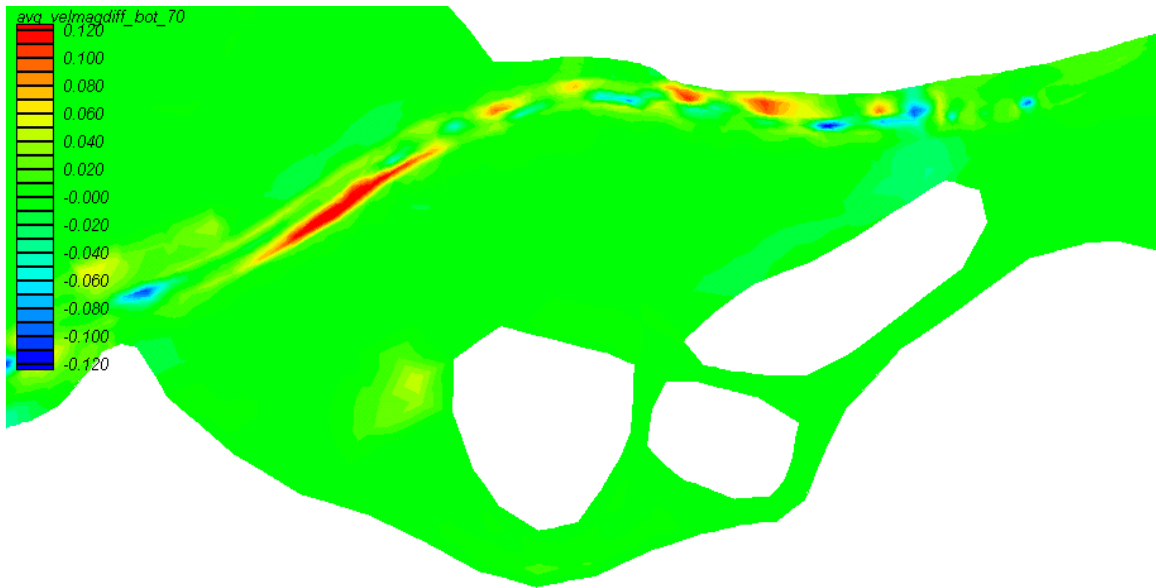


Figure 17. Cathlamet average bottom velocity magnitude difference (ft/sec). 70k flow. Finer scale.

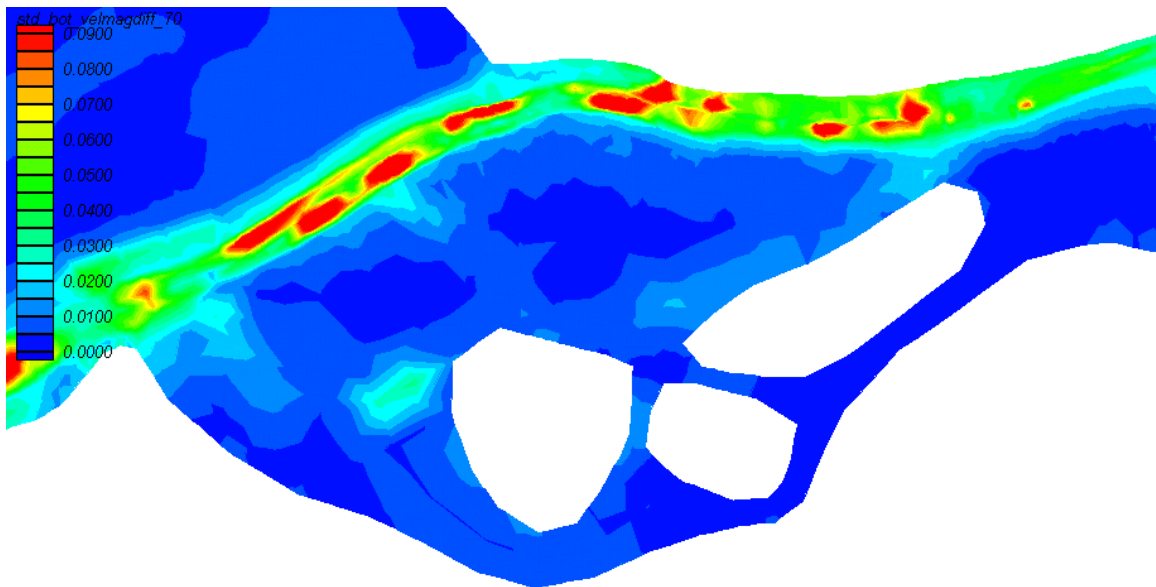


Figure 18. Cathlamet Bay standard deviation of bottom velocity magnitude differences (ft/sec). 70k flow. Finer scale.

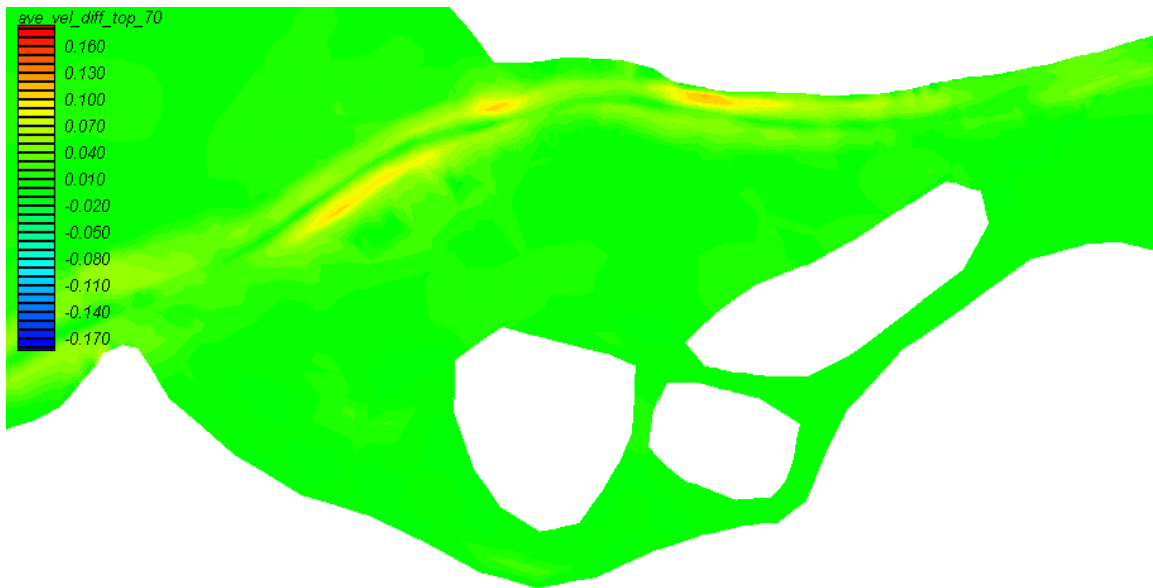


Figure 19. Cathlamet Bay average surface velocity magnitude differences (ft/sec). 70k flow.

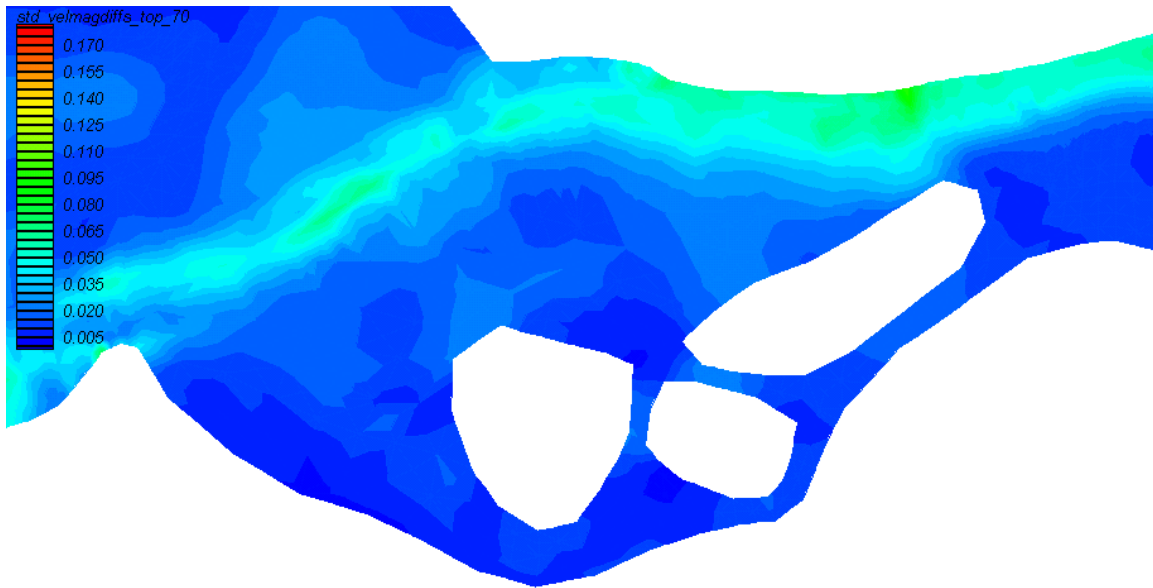


Figure 20. Cathlamet Bay standard deviation of surface velocity magnitude differences (ft/sec). 70k flow.